

WE CLAIM:

1. A preheating apparatus for particulate material comprising:
 - (A) a lower chamber comprising (i) a sloped floor having a center section and an outer annular preheating section which circles the center section; (ii) a material outlet located in the vicinity of the center section for discharging preheated particulate material out of the chamber; (iii) a roof having a perimeter, an upper side, a lower side and a plurality of holes that extend therethrough, each of which are located near the perimeter of the roof and which are arranged in a circular array; (iv) vertical side walls which extend from the perimeter of the roof to the floor; (v) a gas inlet for receiving hot gas into the chamber for flow in countercurrent heat exchange with the particulate material and (vi) means for moving particulate material in the lower chamber toward the material outlet; and
 - (B) an upper preheating and material delivery area comprising a plurality of essentially vertically oriented, elongated hollow feed cassettes for preheating particular material which travels down through each cassette by gravity and for delivering said preheated material to the outer annular section of the lower chamber through the holes in the roof to form material piles on the outer annular section, each cassette having
 - (i) a top and a bottom; and
 - (ii) a material inlet located near its top;
 - (iii) gas outtake means, located near its top, for collecting gas that has passed through particulate material in countercurrent heat exchange, and directing said gas out of the preheater; and
 - (iv) a gas inlet, located at its bottom, for receiving preheating gas that passes through the holes in the roof from the lower chamber;

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wherein each cassette is positioned over at least one hole, and wherein said cassettes are not in contact with and are spaced from each other and are spaced from the perimeter of the roof ~~and~~ ,

2. The apparatus of claim 1 wherein the cassettes are evenly spaced from each other.
3. The apparatus of claim 1 wherein the cassettes are evenly spaced from the perimeter of the roof.
4. The apparatus of claim 1 wherein at least one cassette is cylindrical.
5. The apparatus of claim 1 wherein at least one cassette has a truncated conical shape.
6. The apparatus of claim 1 wherein at least one cassette has, at its bottom, a symmetrical horizontal cross section.
7. The apparatus of claim 6 wherein said at least one cassette has, at its bottom, a circular horizontal cross section.
8. The apparatus of claim 1 wherein the bottom of at least one cassette extends through a hole and into the lower chamber.
9. The apparatus of claim 1 wherein the number of cassettes are equal to the number of holes in the roof.
10. The apparatus of claim 1 wherein the roof is flat.
11. The apparatus of claim 10 wherein the perimeter of the roof has a knuckle profile.
12. The apparatus of claim 1 wherein the means for moving particulate material in the lower chamber is a plurality of reciprocally movable ram-type material pushers for moving particulate material through the chamber toward the material outlet, with there being a pusher underneath each cassette.
13. The apparatus of claim 12 wherein the reciprocally movable ram-type material pushers have an upper and lower surface and a front face and rear end, wherein the upper surface of the material pusher has at least two steps, with the step closest to the front face being